Orbital's

ISS Commercial Resupply Service

Presented to:

Augustine Commission

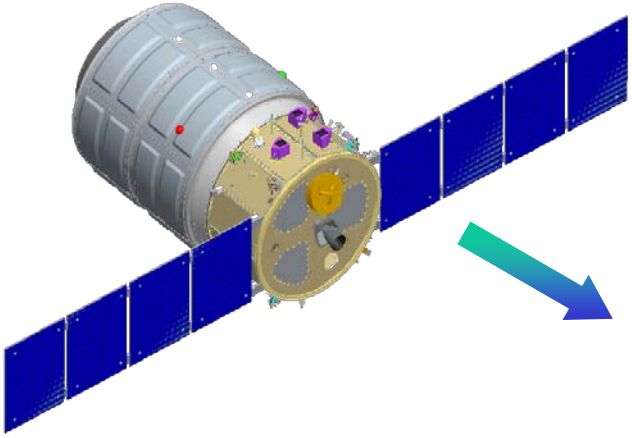
June 17, 2009

Innovation You Can Count On™

ORB Listed NYSE THE NEW YORK STOCK EXCHANGE

Orbital COTS Systems Architecture

The Orbital COTS System is comprised of 5 Major Elements



Cygnus Visiting Vehicle

Orbital COTS System

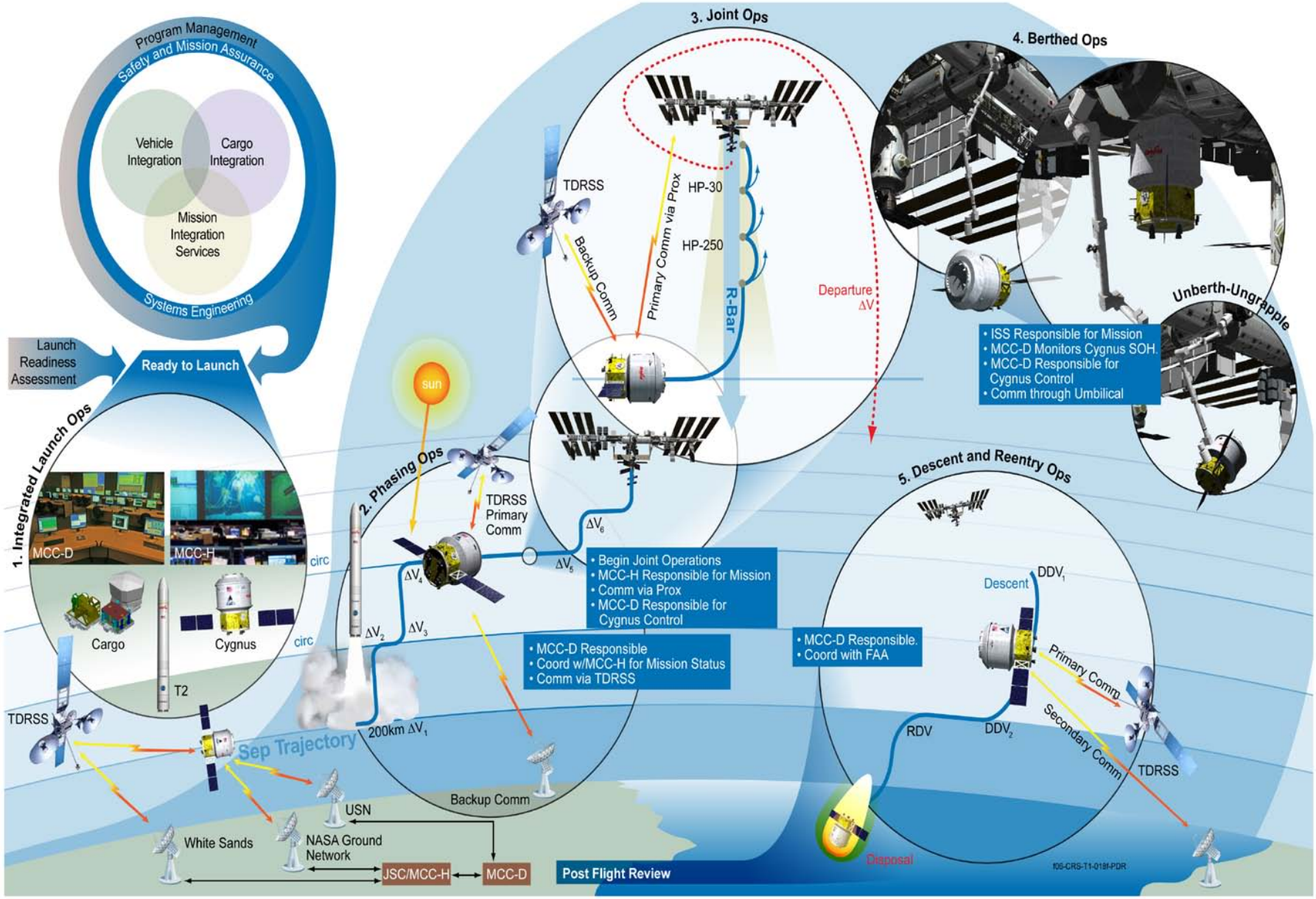
Taurus II

Cargo Operations

Mission Operations

Integrated Launch Site Operations

COTS Mission Overview



Taurus II

MEDIUM-CLASS LAUNCH SERVICES FOR THE 21ST CENTURY

- **Two-Stage Launch Vehicle Designed to Provide Reliable, Cost-Effective, and Responsive Access to Orbit and Earth Escape for Medium-Class Payloads**
- **Designed to be a Highly-Reliable Launcher to Meet NASA Category 3 and Similar DoD Mission Success Standards, and Incorporates Flight-Proven Subsystems to Reduce Development Cost, Schedule and Risk**
- **Initial Missions are Nine Cargo Delivery Launches to the International Space Station (ISS) Under a Demonstration of Commercial Orbital Transportation Services (COTS) Agreement and Under a Commercial Re-Supply (CRS) of the ISS Contract**

Leverages Flight-Proven Technologies

- First Stage Powered by Dual AJ26-62 Engines, Second Stage Propulsion Provided by a Castor 30 Solid Motor (Castor 120 Heritage)
- Optional N2H4/NTO-Fueled Orbit Raising Kit is Available
- Enhanced Second Stage will be Available in 2013

Fills Medium-Class Launch Services Gap

- Fills the Gap Between Medium-Light Minotaur IV-Class Vehicles and Heavy-Lift Delta IV and Atlas 5 Offerings

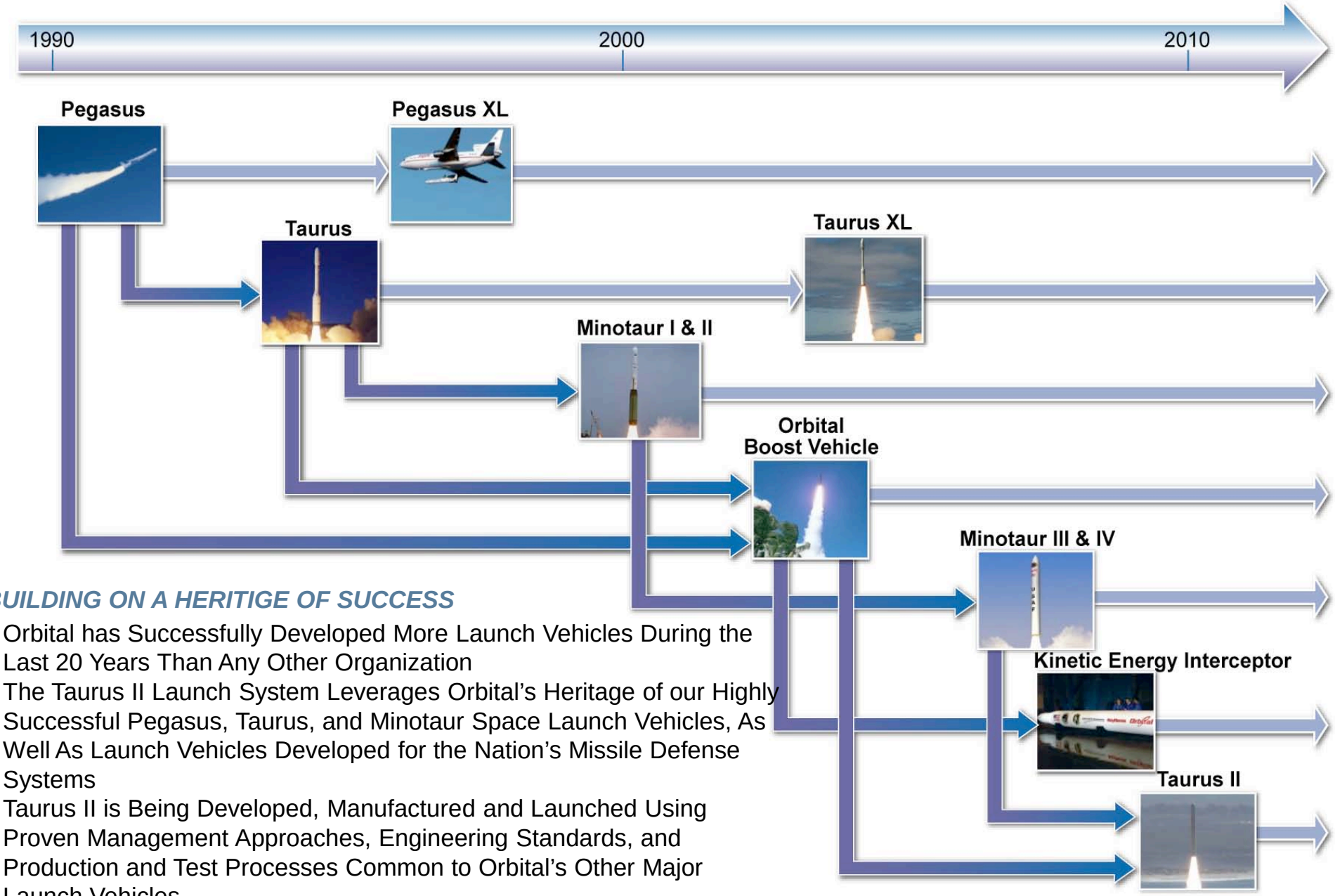
Low Risk Design

- Incorporates Flight-Proven Components from Leading Global Suppliers
- Uses Subsystems Already Successfully Deployed on other Orbital Launch Vehicles

Affordable

- Projected Launch Services Prices Represent Significant Savings Over Existing Medium-and Heavy-Class Launchers, Reducing Total Mission Cost

Two Decades… 11 Space and Strategic Launch Vehicles

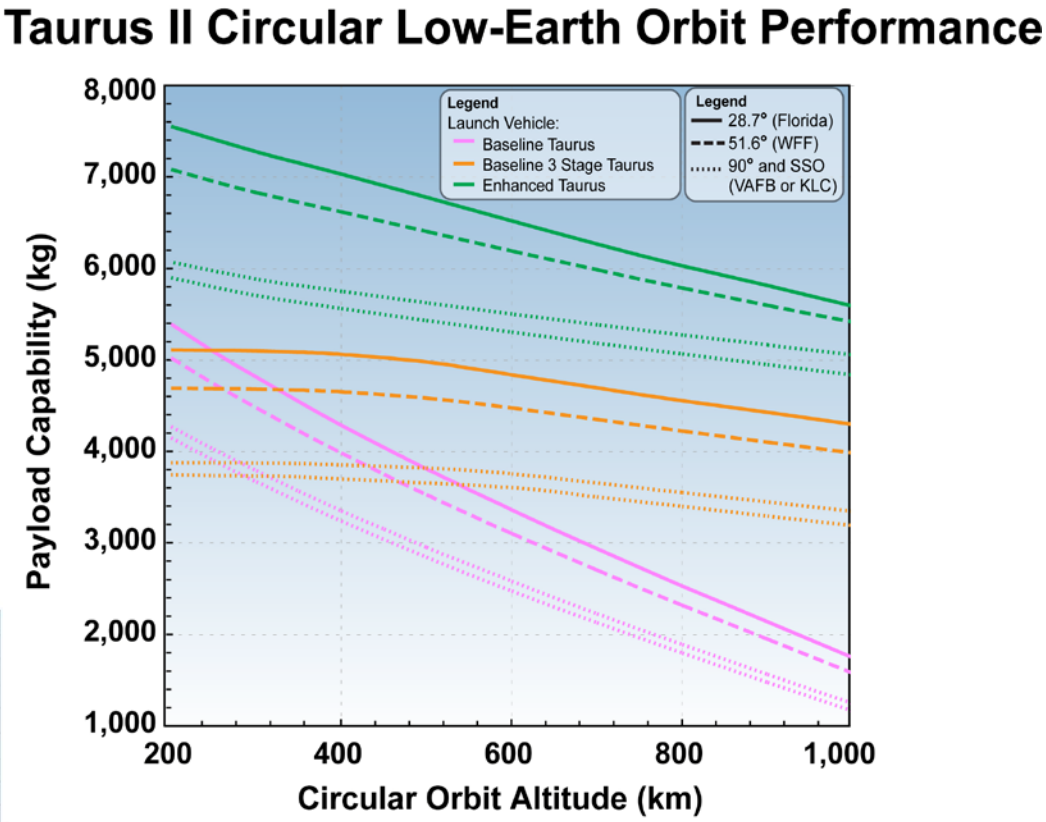


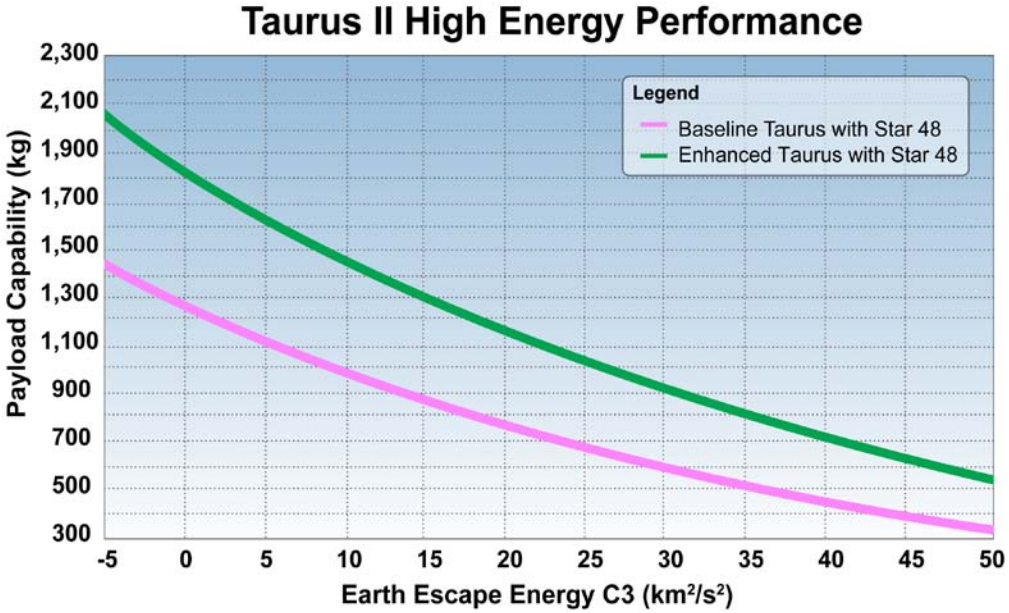
BUILDING ON A HERITIGE OF SUCCESS

- Orbital has Successfully Developed More Launch Vehicles During the Last 20 Years Than Any Other Organization
- The Taurus II Launch System Leverages Orbital's Heritage of our Highly Successful Pegasus, Taurus, and Minotaur Space Launch Vehicles, As Well As Launch Vehicles Developed for the Nation's Missile Defense Systems
- Taurus II is Being Developed, Manufactured and Launched Using Proven Management Approaches, Engineering Standards, and Production and Test Processes Common to Orbital's Other Major Launch Vehicles

Taurus II Performance

Taurus II Encompasses
Entire Medium-Class Range

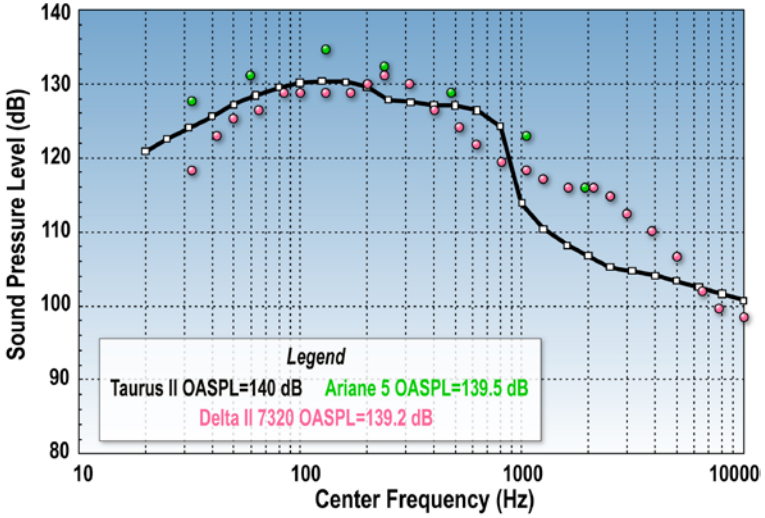




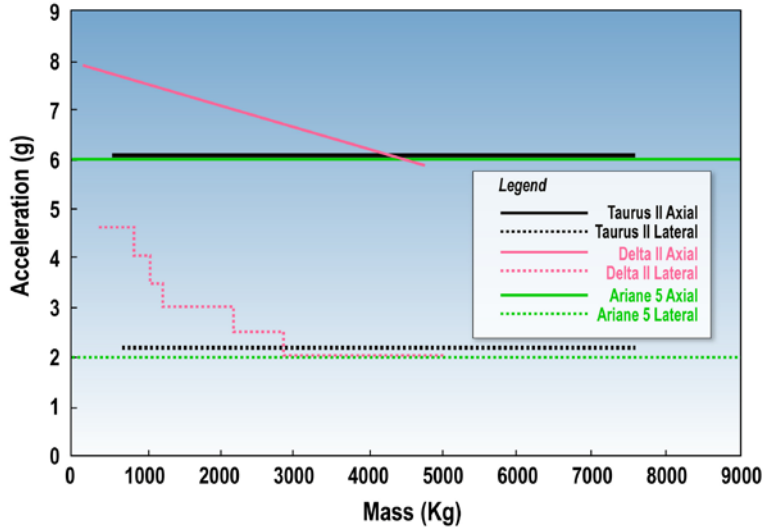
Baseline Taurus II
Equivalent to Delta 7920.
Enhanced Taurus II
Equivalent to Atlas IIAS.

Taurus II Environments

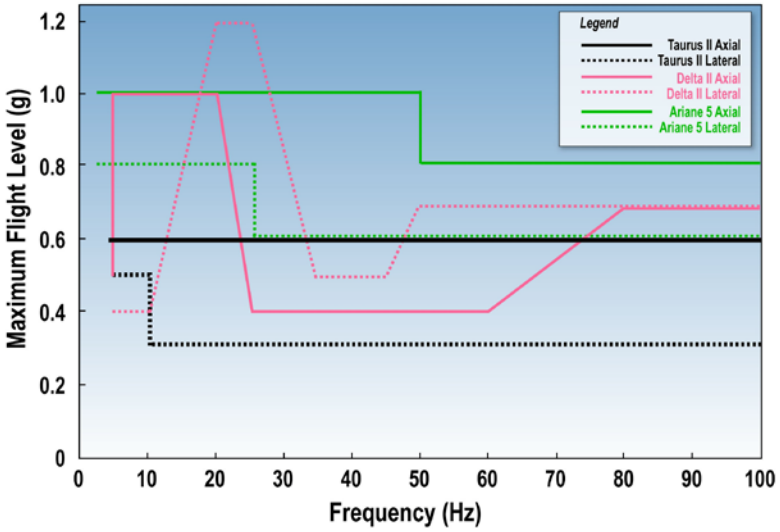
Acoustics



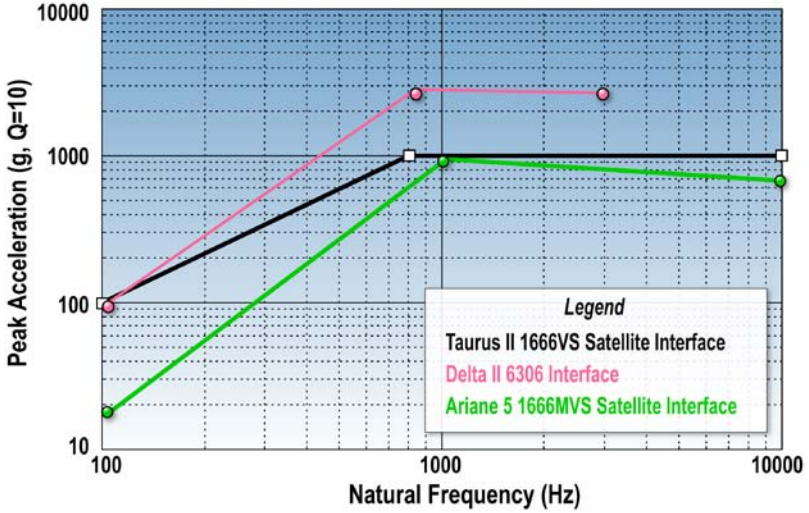
Quasi-Static Acceleration



Sine Vibe



Shock



Taurus II Environments Similar to Comparable Vehicles

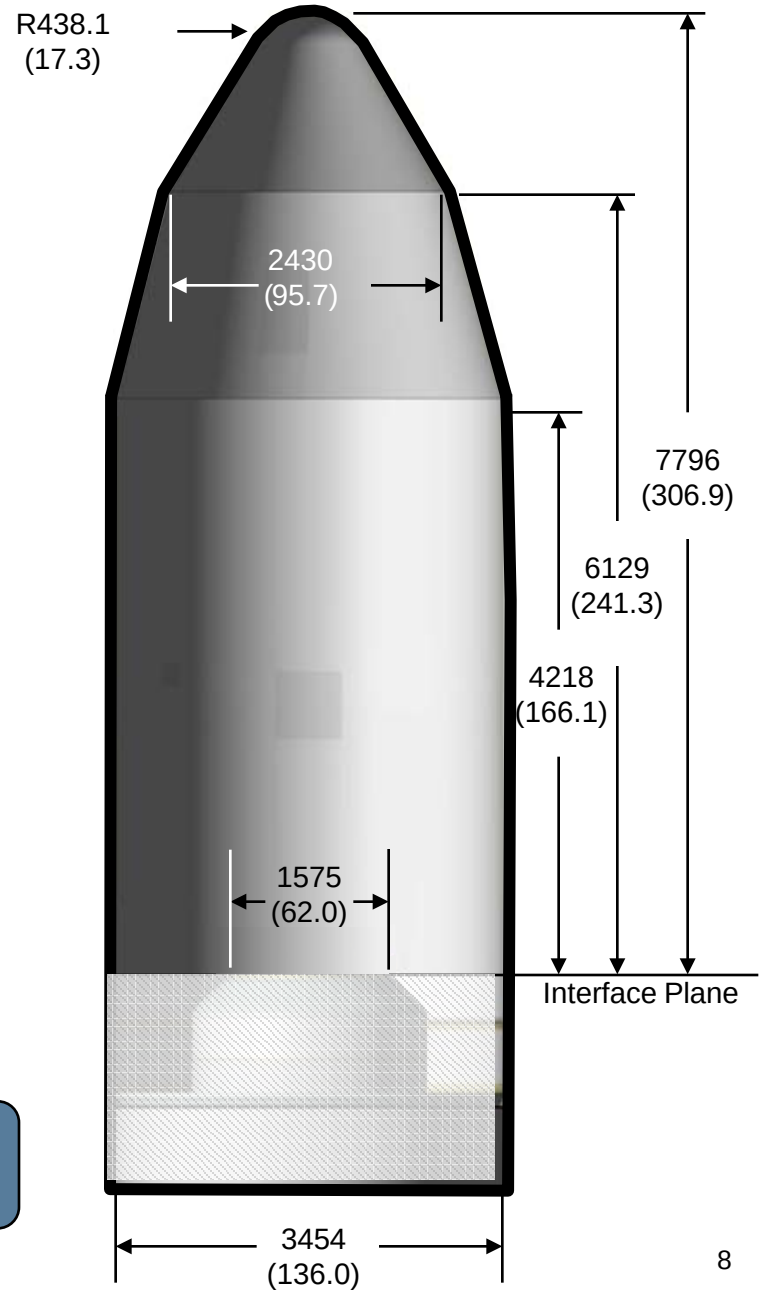
Taurus II Payload Accommodations

- Taurus II Bi-conic Payload Fairing Volume Exceeds the Medium Class Payload Envelope Simplifying Design of Payloads with Large Deployables

- Spacecraft Handling Operations Maximize Payload Integration Effectiveness
  - Processing Scheme Minimizes Contamination Risk by Allowing Late Access for Removal of Covers
  - Launch Vehicle Processing Flow Minimizes Pad Time and Significantly Reduces Payload Risk due to Exposure to Elements

- All Anticipated Level of Services Provided
  - Contamination Control Available for Sensitive Payloads
  - Flexible Mechanical and Electrical Interfaces and Door Locations Accommodates Wide Range of Payload Requirements

Payload Accommodations Provide Greater Design Flexibility and Safe and Efficient Processing



Taurus II Launch Sites

LAUNCH SITES

Wallops Flight Facility is Baseline Launch Site for Initial Taurus II Launches, Supporting COTS/CRS

However Taurus II Vehicle is Compatible with Multiple U.S. Launch Ranges Providing Customers with a Variety of Capabilities

Kodiak Launch Complex (KLC)

- KLC in Alaska Provides Taurus II with a Prime Location for Launching High Inclination, Sun-Synchronous Missions

Vandenberg Air Force Base (VAFB)

- VAFB in California is a Another Prime Location for High Inclination, Sun-Synchronous Launches

Wallops Flight Facility (WFF)

- NASA's WFF in Virginia is Home to the Taurus II COTS/CRS Launch Program and Supports Mid-Inclination and High Energy Missions

Cape Canaveral Air Force Station (CCAFS)

- CCAFS in Florida Along with NASA's Kennedy Space Center Provides Taurus II with a Veteran Launch Location for Low-Inclination and Specialized Missions

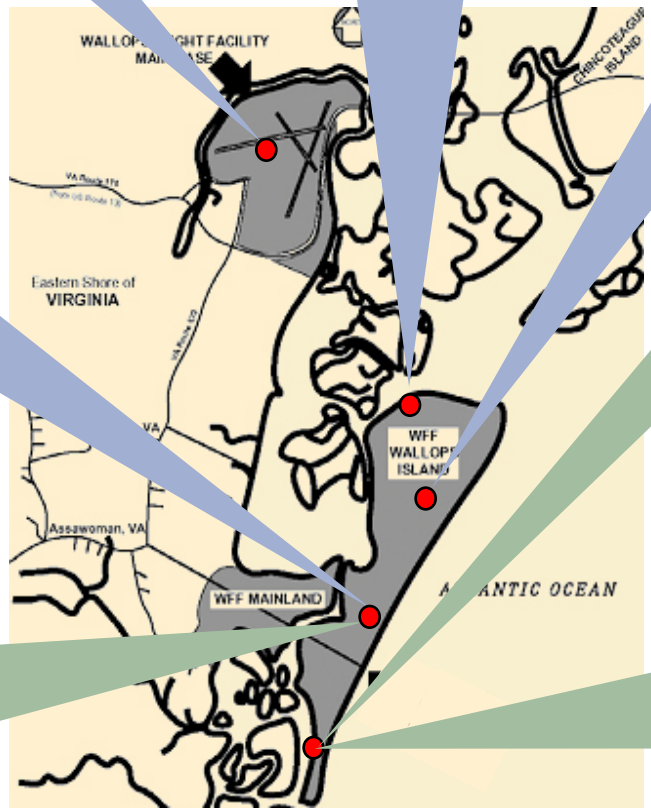
Taurus II Facilities at Wallops Island

Cargo Processing Bldg

Road & Dock

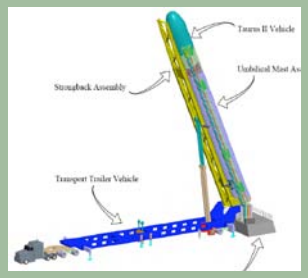
Payload Fueling Facility

Horizontal Integration Facility

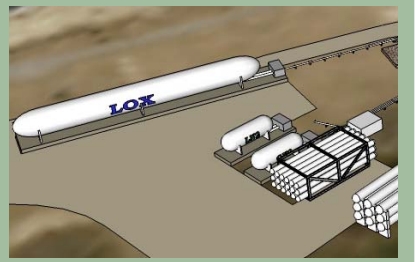


Launch Pad

Transporter/Erector



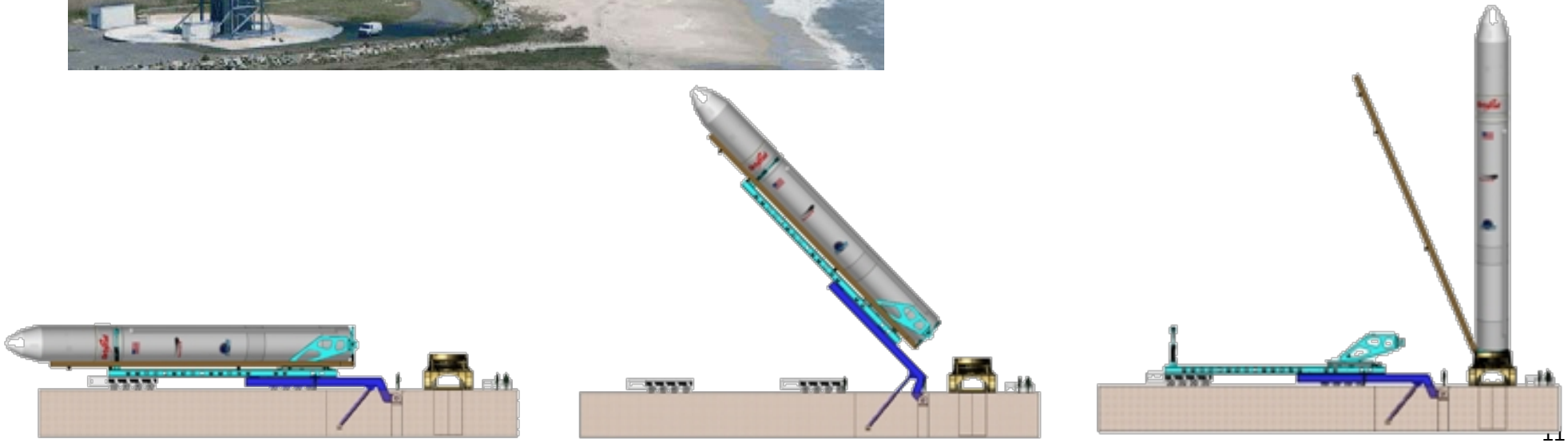
Liquid Fueling Facility



Taurus II Launch Infrastructure

HORIZONTAL LAUNCH VEHICLE PROCESSING

- Horizontal Payload Mate
- Payload Encapsulation Prior to Roll-Out
- Integrated Launch Vehicle Transported 1.2 Miles From HIF to Launch Complex
- Launch Complex Provides Launch Mount, Flame Trench, and Fuel Loading Subsystem



Stennis E-1 Engine Test Stand
Flame Duct Construction Progressing

Stage 1 Engines at Aerojet in Sacramento, CA

C1208 7742

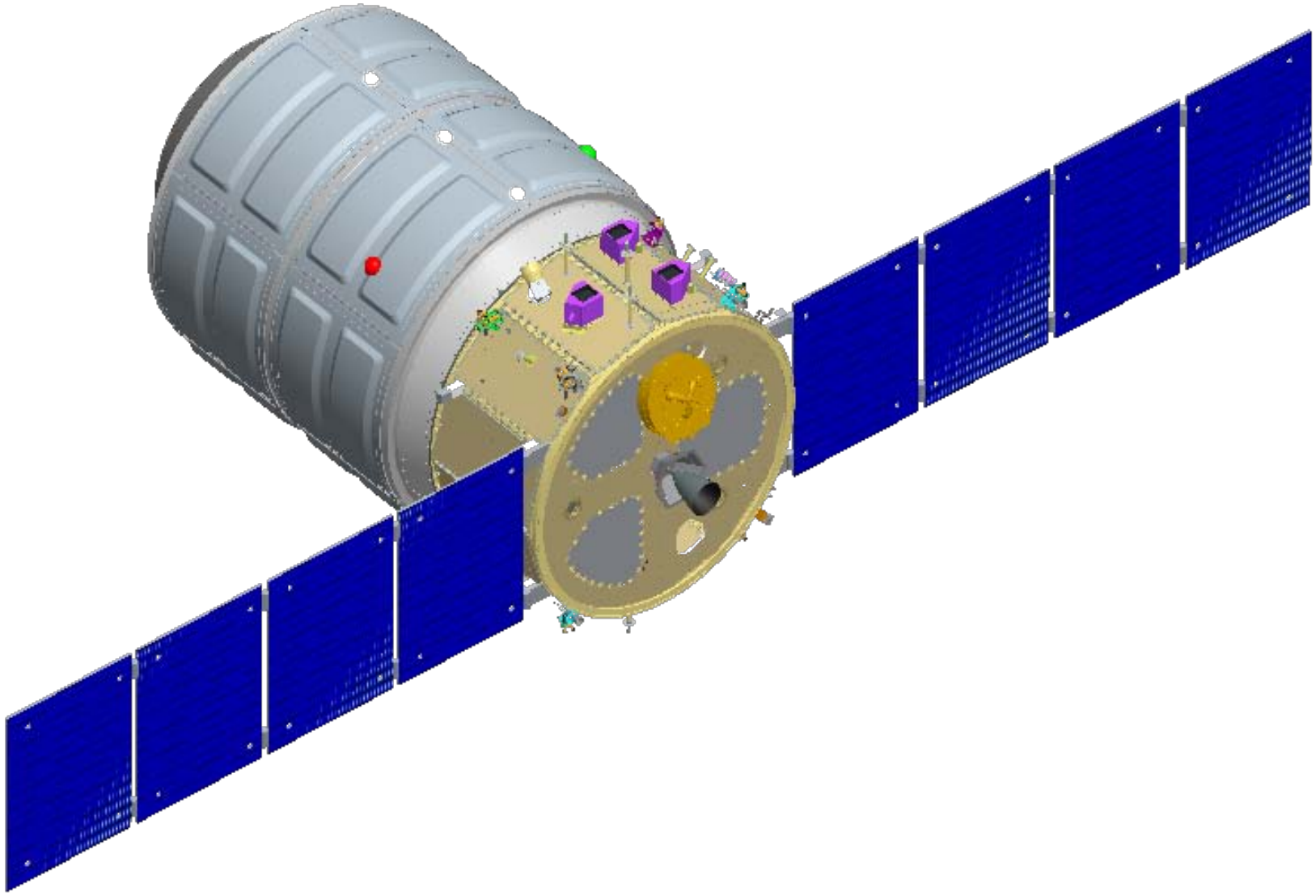
C1208 7769

C1208 7774

Castor-30 Second Stage Static Fire Motor Assembled

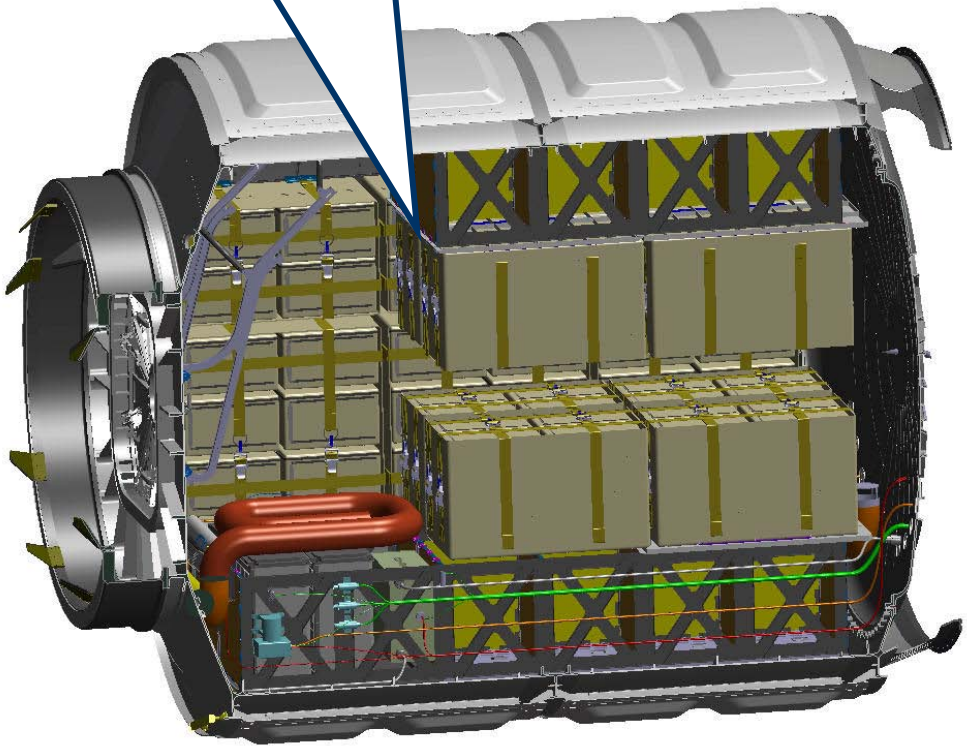
Payload Fairing Mold Tool

Cygnus Visiting Vehicle

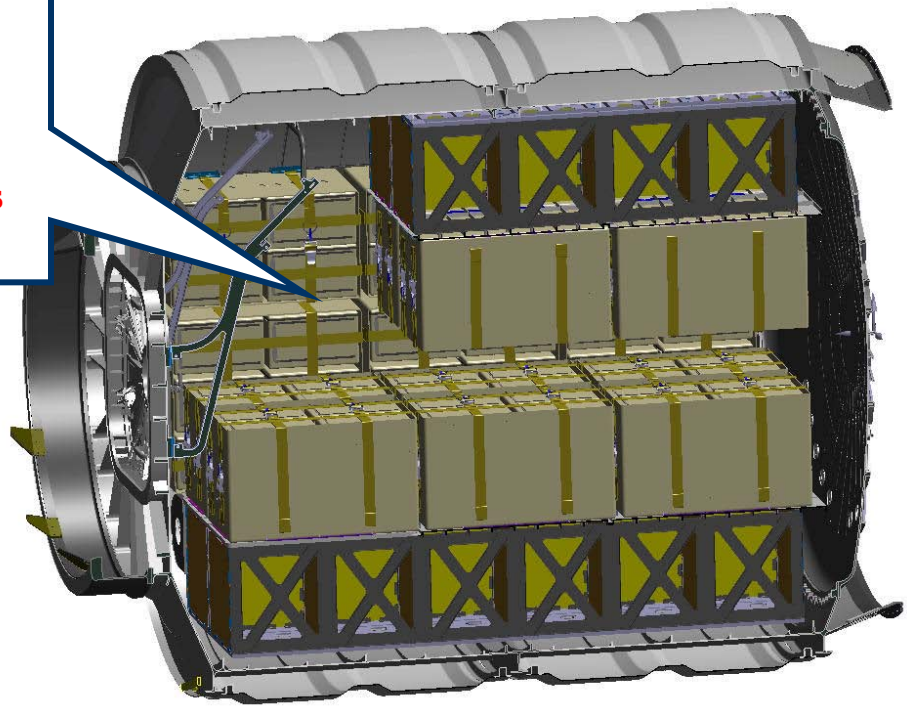


Pressurized Cargo Module Cargo Accommodation

Active Configuration
- Internal Volume 18.75 m^3
Cargo Capabilities:
- **35 CTB's**
- **14 M02**
- **6 M01**
- **4 Mid Deck Lockers**
- **Equal to 1902 Kg of Cargo Mass**

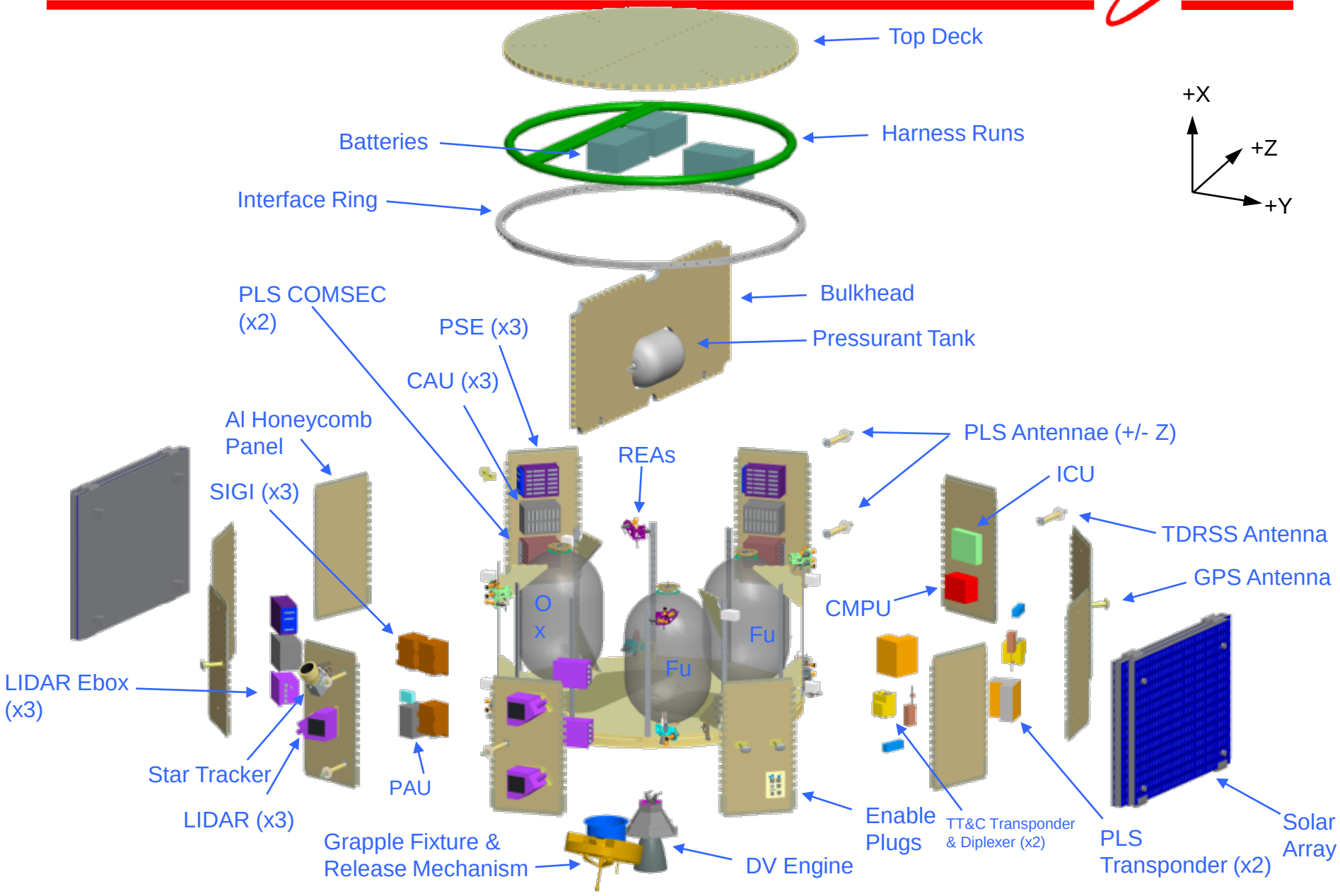


Passive Configuration
- Internal Volume 18.75 m^3
Cargo Capabilities:
- **42 CTB's**
- **10 M02**
- **6 M01**
- **Equal to 1988 Kg of Cargo Mass**



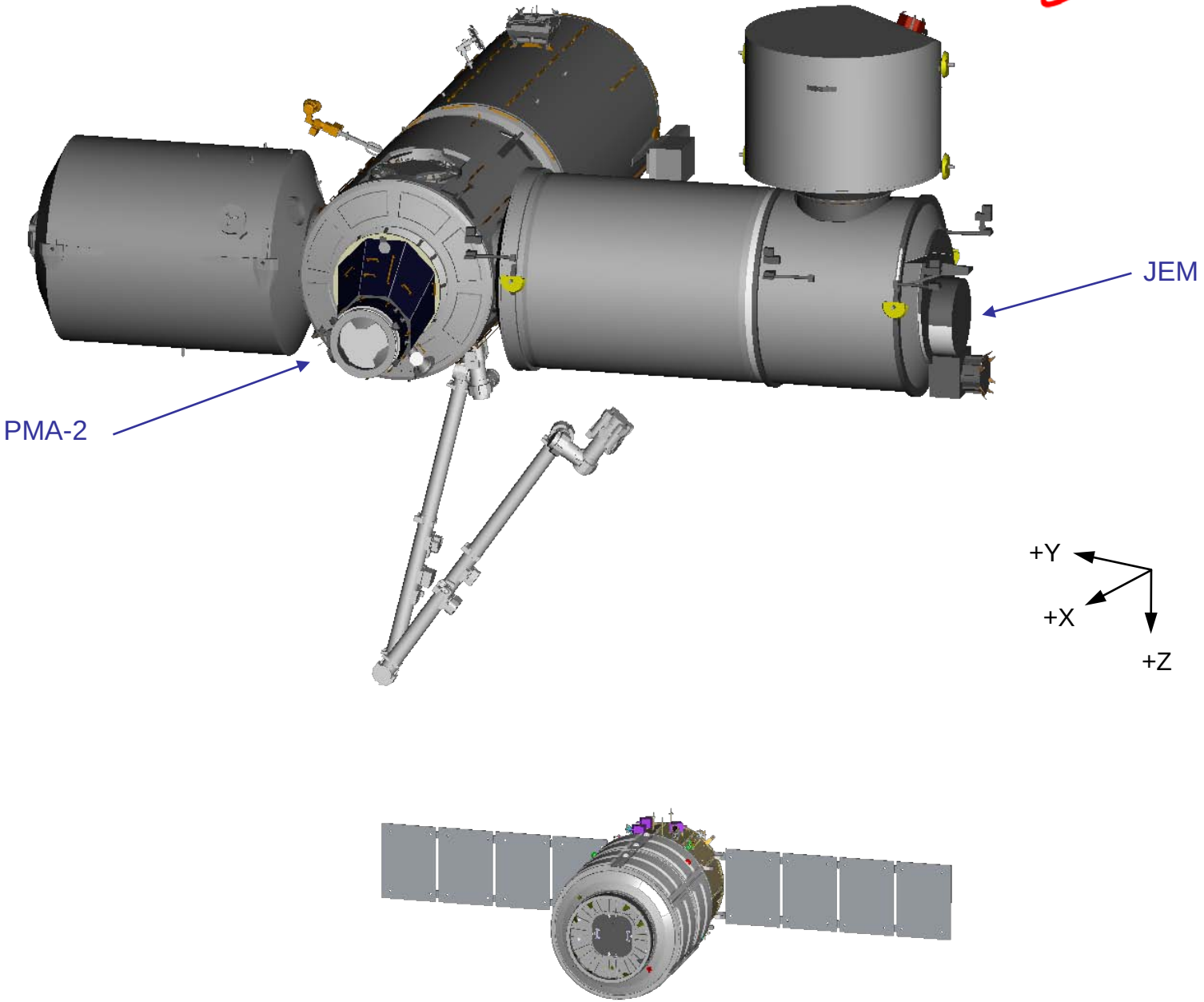
Assumptions:
31 Kg for a single Mid Deck Locker
14 Kg of average mass for each CTB

SM Expanded View - Annotated

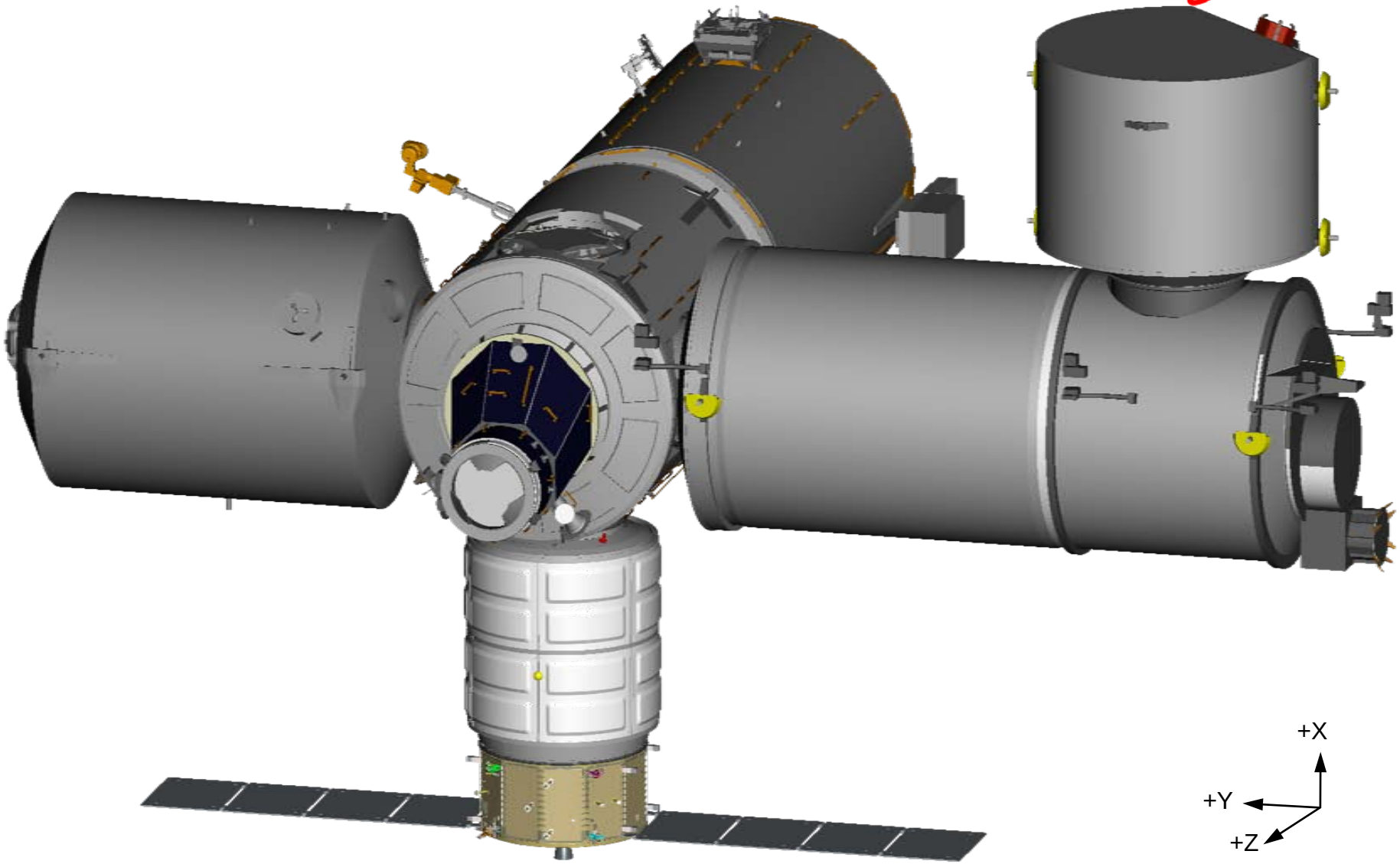


HCP Overview

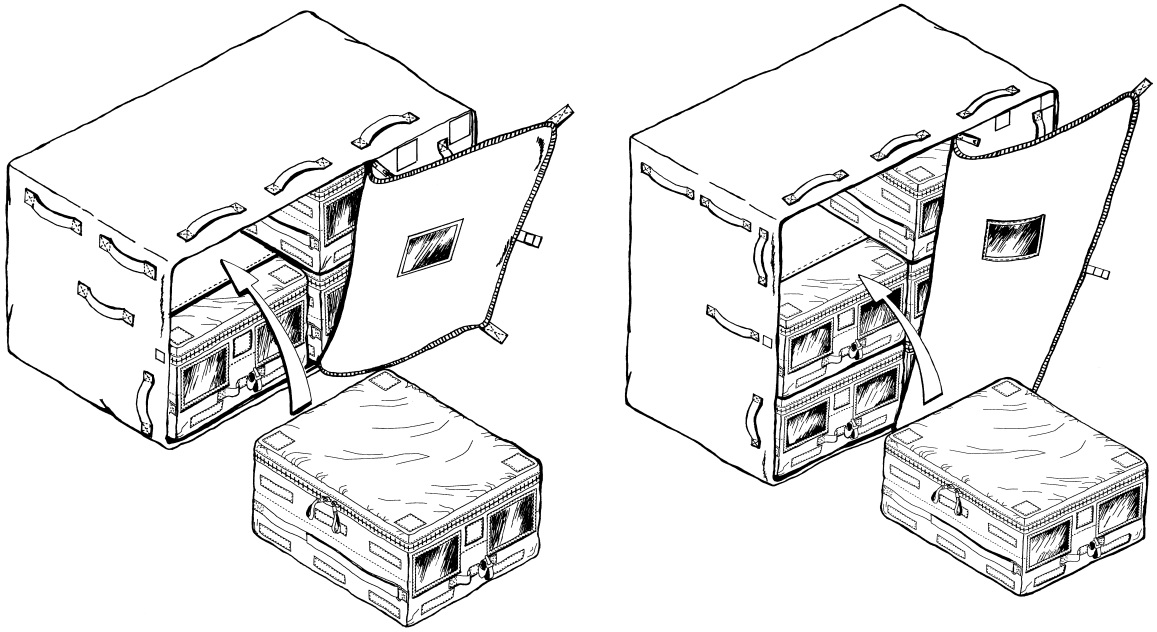
Cygnus Visiting Vehicle (Free Flight)



Cygnus Visiting Vehicle (Berthed at Node 2 Nadir)

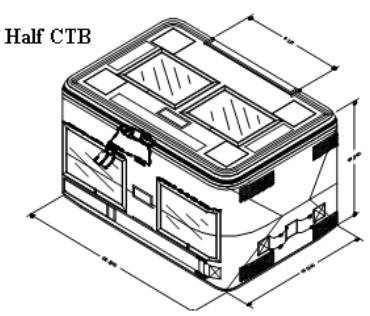


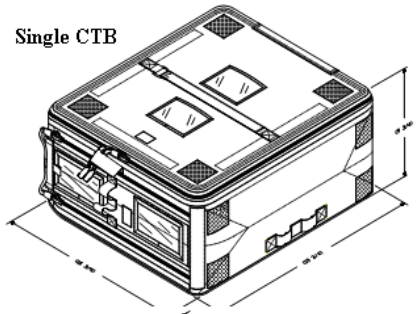
Standardized Cargo Bags

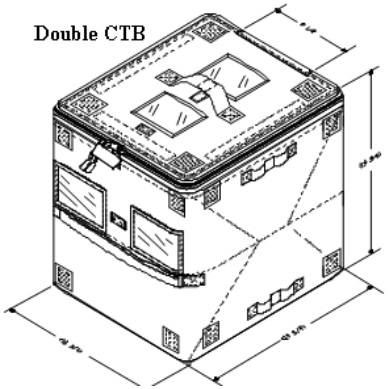


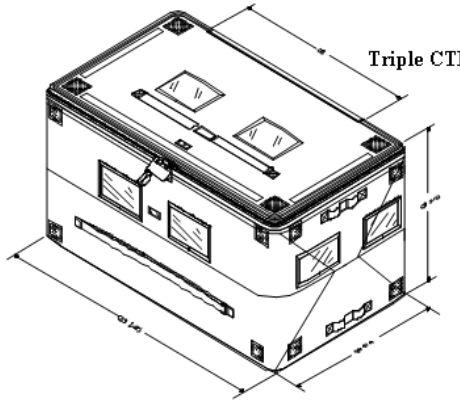
M1 and M2 Cargo Bags

Cargo Transfer Bags (CTB)



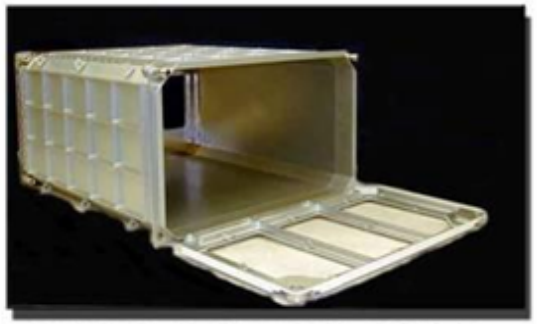




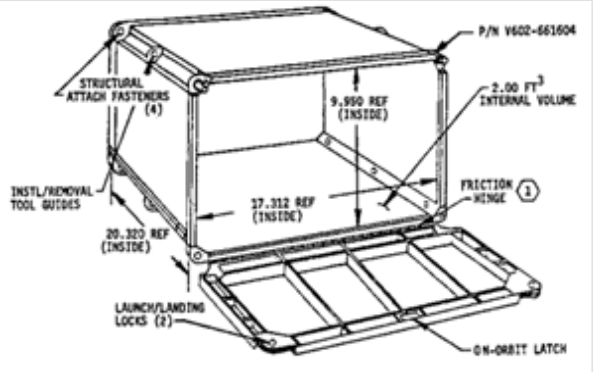


Mid-Deck Lockers and Cold Bags

Mid-Deck Locker



SINGLE STOWAGE LOCKER
(P/N SEG46117022-302
DOOR SHOWN OPEN)



ICEPAC (Use in Coldbags)

Single and Double Coldbags

Trash on ISS

iss004e9650

International Space Station Today

S119E010307

Current Status of COTS/CRS

- Commercial Orbital Transportation Service (COTS) Demonstration Mission
  - Orbital has completed 10 Milestones out of 21
  - System Level Preliminary Design Review Completed
  - Safety Review Panel Phase 1 Completed
  - Changed Demonstration from Unpressurized Cargo to Pressurized Cargo to better represent the majority of NASA Cargo
  - Updated Space Act Agreement to Provide NASA with Much Higher Fidelity Demonstration and Significant Additional Value
  - Mission Scheduled for Early 2011
- Commercial Resupply Services (CRS)
  - Completed First two Milestones
  - Next major milestone is Vehicle Baseline Review at Launch – 13 months
  - Cargo Manifesting Process being worked with NASA

APG PMR – COTS
Schedule Milestones